Silver Nanoparticles: Properties, Characterization and Applications, 2011, pages 169-219

Ion-synthesis of silver nanoparticles and their optical properties

Stepanov A.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

Recent results on ion-synthesis by low energy implantation and optical properties of silver nanoparticles in various dielectrics (glasses and polymers) and on the interaction of high power laser pulses with such composite materials are reviewed. One of the features of composites prepared by the low energy ion implantation is the growth of metal particles with a wide size distribution in the thin depth from the irradiated substrate surface. This leads to specific optical properties of implanted materials, partially to difference in reflection measured from implanted and rear face of samples. The excimer laser pulse modification of silver nanoparticles fabricated in silicate glasses are considered. Pulsed laser irradiation makes it possible to modify such composite layer, improving the uniformity in the size distribution of the nanoparticles. The optical absorption of silver nanoparticles fabricated in polymer is also analysed. Unusual weak and broad plasmon resonance spectra of the nanoparticles is studied in the frame of the carbonisation of ion-irradiated polymer. Based on the Mie theory, optical extinction spectra for metal particles in the polymer and carbon matrices are simulated and compared with partical spectra for complex silver core-carbon shell nanoparticles. A new experimental data on nonlinear optical properties of synthesised silver nanoparticles are also presented.